

CoBOP Data Analysis and Research Group Coordination

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<http://www.psicorp.com/cobop>

LONG-TERM GOAL

The long-term goal of this research is to gain an understanding of the nature and significance of fluorescence and reflectance characteristics of benthic marine organisms in general, and coral reef cnidarians in particular. We wish to determine 1) how biological processes act to produce the optical properties and 2) how optical measurements can be used to provide insight into biological state or process.

OBJECTIVES

The primary objective for FY02 was to produce manuscripts for publication in a special issue of *Limnology and Oceanography*. The second objective was to continue to analyze data for additional peer-review publication. The third objective was to continue to serve the CoBOP group as Chief Scientist.

APPROACH

This award is a follow-on to our work funded under the Coastal Benthic Optical Properties (CoBOP) Departmental Research Initiative (ONR contract N0001498C0137) (Mazel, 2001). The data our group collected in the fieldwork portion of that project is being analyzed, focused on specific research topics, and reported in peer-reviewed publications. The CoBOP work as a whole has motivated a special issue of *Limnology and Oceanography* that will be published in early 2003, and the thrust of this year's effort has been to produce manuscripts for that issue. This work was undertaken in collaboration with researchers from both inside and outside the CoBOP research group.

Additional data analysis is being undertaken that should result in additional publications. This includes work on reflectance of benthic surfaces, techniques for in situ measurement of reflectance, and direct energy coupling between fluorescent pigments.

The efforts in coordinating the CoBOP research group include: maintenance of public (<http://www.psicorp.com/cobop>) and private (<http://www.psicorp.com/lsi>) web sites; planning, on-site organization, and leadership of the annual CoBOP research/data review meeting; and planning for the FY03 CoBOP workshop.

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WORK COMPLETED

Three first-authored manuscripts were completed and submitted for possible inclusion in the special issue of *Limnology and Oceanography* to be devoted to shallow water optics and remote sensing. Once reviewers' comments were received I coordinated each set of co-authors in modifying the manuscripts (in some cases quite extensively) and responding to the comments. The three topics were those referenced in last year's CoBOP annual report (Mazel, 2001):

- Demonstration of the potential to use imagery generated by the Fluorescence Imaging Laser Line Scanner (FILLS) to perform automated classification of coral reef surfaces (Mazel et al., 2003a);
- Characterization of green-fluorescent protein (GFP) in Caribbean corals, including data related to hypotheses about the possible function of the protein (Mazel et al., 2003b);
- A mathematical approach combining measured and modeled data to quantify the contribution of fluorescence to the spectral signature and apparent color of corals (Mazel and Fuchs, 2003).

In addition I participated as co-author on an additional manuscript (Voss et al., 2003).

A poster presentation on seafloor fluorescence imaging was made at the AGU/ASLO Ocean Sciences meeting in February (Mazel et al., 2002).

The CoBOP data workshop was held successfully in February 2002. Site selection for the FY03 workshop has been completed. The CoBOP web sites have been kept up to date. The public access web site (<http://www.psicorp.com/cobop>) includes links to lists of CoBOP-related peer-reviewed publications and conference presentations.

RESULTS

All of the manuscripts in which I participated were accepted after revision for publication in *Limnology and Oceanography*.

The list of CoBOP-related peer-reviewed publications now includes fifteen titles, and the list of conference presentations is now above seventy-five. The former list will be increased substantially once the special issue of *Limnology and Oceanography* is published.

IMPACT/APPLICATIONS

The conversion of field research to peer reviewed publication is the critical step in making the products of ONR-funded research generally accessible to the scientific community. The GFP and coral color papers will contribute to the ongoing international effort to understand the functional role of the fluorescent pigments in coral reef ecology. The FILLS image analysis paper will make this Navy-funded technique more generally known, with the hope of stimulating further research and application funding, whether from ONR or other sources.

TRANSITIONS

The mathematical approach to determining the contribution of fluorescence to coral color is general in nature, and is now being applied to other marine organisms in which fluorescence has recently been discovered. This new work is being carried out in collaboration with a new group of researchers not affiliated with the CoBOP program.

RELATED PROJECTS

Our work conducted under the CoBOP program has spun out into a new ONR-funded project to advance our understanding of fluorescence in the marine environment (Mazel, 2002).

REFERENCES

Mazel, C. H. 2001. Coastal Benthic Optical Properties (CoBOP): Optical Properties of Benthic Marine Organisms and Substrates. ONR FY01 Annual Report.

Mazel, C. H. 2002. Characterization of Fluorescence in the Marine Environment. ONR FY02 Annual Report, this volume.

Mazel, C H, Zawada, D G, Jaffe, J S, Carder, K L, Costello, D K, Hou, W, Strand, M P, Nevis, A J, Coles, B, Sitter, D N, Gelbart, A , 2002. Advances in Fluorescence Imaging of the Sea Floor. Poster presentation at AGU/ASLO 2002 Ocean Sciences Meeting, Honolulu, HI, February 2002.

PUBLICATIONS

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Mazel, C. H., M. P. Lesser, M. Y. Gorbunov, T. M. Barry, J. H. Farrell, K. D. Wyman, and P. G. Falkowski. 2003b. Green-fluorescent proteins in Caribbean corals. *Limnol. Oceanogr.*, in press.

Mazel, C. H., and E. Fuchs. Contribution of fluorescence to the spectral signature and perceived color of corals. 2003. *Limnol. Oceanogr.*, in press.

Voss, K., C. D. Mobley, L. K. Sundman, J. Ivey, and C. H. Mazel. 2003. The spectral upwelling radiance distribution in optically shallow waters. *Limnol. Oceanogr.*, in press.